Remarks/Arguments

Claims 1-28 remain in the application. Claims 1, 2, 7-9, 13-17, and 21 have been amended.

Specification

Applicant has provided herewith a replacement abstract of the disclosure composed of a single paragraph. The amendment does not add new subject matter.

Claims

Claims 1, 2, 7-9, 13-17, and 21 have been amended in order to avoid invoking 35 U.S.C. 112, sixth paragraph. In particular, all instances of phrases such as --the steps of--, and -- the step of-- have been deleted. Applicant wishes to note for the record that the amendments are not intended to be narrowing, nor are the amendments being made for a reason related substantially to patentability. Applicant respectfully submits that no new matter has been added in the amendments.

Claim Rejections – 35 USC § 102

Claims 1, 2, 8, 23-25, 27, and 28 are rejected under 35 U.S.C. 102(e) as being unpatentable by Niu et al U.S. Patent No 6,263,195 B1.

Referring to claim 1, Applicant discloses and claims a method for real-time digital spectral analysis of wide-band signals defined by the following features (emphasis added):

> receiving a wide-band signal;
> **shifting the center frequency of the wide-band signal by a small fraction ε of its bandwidth;**
> sampling and digitizing the wide-band signal;
> processing the digitized wide-band signal using a digital filter; and,
> decimating the digitally filtered wide-band signal.

A digital filter has a finite transition band. After decimation, the transition band outside sub-band boundaries will suffer aliasing, which causes signals to falsely appear as aliased signals within the sub-band and will appear as aliased "quantization noise" in the wide-band spectrum after, for example, cross-correlation of the sub-band signals. The method defined in claim 1 is highly advantageous by preventing false correlation of aliased signals due to the feature of: *shifting the center frequency of the wide-band signal by a small fraction* ε *of its bandwidth* **before** sampling and digitizing of the wide-band signal. The frequency shift and subsequent removal after filtering causes aliasing signals from filter sub-band transition bands to be attenuated with averaging time. Therefore, aliased signals are suppressed depending on the averaging time and the value of the frequency shift ε.

Cited reference Niu et al. teaches a wide-band digital tuner for filtering, shifting, and down-converting of de-multiplexed digital data. In particular, Niu et al. teach in col. 6 lines 16-54 and referring to element 44 cited by the examiner: "shifting the frequency of the output from the downsampler 42 by a frequency shift equal to one quarter of data sampling rate Fs. .... The frequency shift 44 outputs I and Q data signals which are shifted to a correct frequency position to align the I and Q data in frequency with channels to be produced by the channelizer.... It positions the waveform for the next stage such as channelization."

Applicant respectfully submits that Niu et al. do **not** teach the feature of: *shifting the center frequency of the wide-band signal by a small fraction* ε *of its bandwidth.* First, Niu et al. teach shifting the frequency of the output from the downsampler, **not** the center frequency of the wide-band signal. Second, Niu et al. teach a frequency shift equal to one quarter of the data sampling rate, **not** a small fraction ε of the bandwidth of the wide-band signal. Third, Niu et al. teach shifting the frequency after digitization – output from downsampler 42, **not** shifting the center frequency of the wide-band signal prior digitization as defined in claim 1.

Applicant respectfully submits that claim 1 is not anticipated by Niu et al. and, therefore, is allowable.

Referring to claim 2, Applicant discloses and claims a method for real-time digital spectral analysis of wide-band signals comprising the same inventive features as the method of claim 1. In particular, claim 2 also defines a method comprising the feature of: *shifting the center frequency of the wide-band signal by a small fraction* ε *of its bandwidth* **before** sampling and digitizing of the wide-band signal. Further, claim 2 has been rejected by the examiner for the same reasons as claim 1. Therefore, the above arguments apply here mutatis mutandis.

Claim 23 is a system claim corresponding to method claim 2 and has been rejected for the same reasons by the examiner. The above arguments apply here mutatis mutandis.

Applicant respectfully submits that each of claims 3-6 depend on a claim that is believed to be allowable and as such are also allowable.

Dependent claim 8 defines the feature of: *phase rotating the* $2^k \cdot N; k = 0,1,...$ *sub-band signals by phase* ε *using a digital phase rotator producing a de-rotated sub-band signal*. The phase rotation by phase ε defined in claim 8 removes, after sub-band filtering, the frequency shift ε which has been applied to the wide-band signal before digitizing as defined by the features of claim 2 on which claim 8 depends.

Applicant respectfully submits that Niu et al. do not teach the feature of claim 8 but complex multiplication, i.e. multiplication of the input signal with a complex sinusoidal waveform to shift it to a lower carrier frequency. The teachings of Niu et al. in col. 5 lines 6-10, as cited by the examiner, do not produce a de-rotated sub-band signal, but an input signal shifted to a lower carrier frequency. Therefore, the feature of claim 8 is not anticipated by the teachings of Niu et al.

Claim 27 is a system claim corresponding to method claim 8 and has been rejected for the same reasons by the examiner. The above arguments apply here mutatis mutandis.

Furthermore, each of claims 8 and 27 depend on a claim that is believed to be allowable and as such are also allowable.

Referring to claim 24, Applicant respectfully submits that Niu et al. teach in Fig. 7, cited by the examiner, digital signal processing which is apparent from the signals being received from the DEMUX 13, and, therefore, cannot teach an *analog mixer and a local oscillator* as stated by the examiner.

Applicant respectfully submits that each of claims 24, 25, and 28 depend on a claim that is believed to be allowable and as such are also allowable.

Claim Rejections – 35 USC § 102

Claim 16 is rejected under 35 U.S.C. 102(b) as being anticipated by Isaksson et al U.S. Patent No. 5,812,523.

Referring to independent claim 16, Applicant discloses and claims a method for cross-correlating de-rotated sub-band signals defined by the following features (emphasis added):

receiving $2^k \cdot N; k = 0,1,...$ pairs of first and second **de-rotated sub-band signals** at $2^k \cdot N; k = 0,1,...$ cross-correlators, wherein **each pair is received at a different cross-correlator** of the $2^k \cdot N; k = 0,1,...$ cross-correlators;

transforming each pair of first and second de-rotated sub-band signals at each of the $2^k \cdot N; k = 0,1,...$ cross-correlators by means of a Fourier Transform into frequency domain;

complex cross-multiplying the Fourier transformed first and second de-rotated sub-band signals at each of the $2^k \cdot N; k = 0,1,...$ cross-correlators; and,

time-averaging the cross-multiplied first and second de-rotated sub-band signals.

In the method of claim 16 pairs of first and second de-rotated sub-band signals are received, wherein each pair is received at a different cross-correlator, as highlighted. Each of the pairs of first and second de-rotated sub-band signals is then transformed into frequency domain and complex cross-multiplied at each of the different cross-correlators. Finally, the cross-multiplied first and second de-rotated sub-band signals are time-averaged.

Cited reference Isaksson et al. teaches a method of demultiplexing OFDM signals and a receiver for such signals. Referring to Fig. 1, Isaksson et al. teach receiving of complex time domain based signals I(t) and Q(t) of an OFDM signal, **not** $2^k \cdot N; k = 0,1,...$ *pairs of first and second de-rotated sub-band signals.* Furthermore, Isaksson et al. do **not** teach *each pair is received at a different cross-correlator of the* $2^k \cdot N; k = 0,1,...$ *cross-correlators.* Finally, Isaksson et al. teach in col. 2 lines 40-42, in col. 4 line 12, and in col. 6 lines 25-28, as cited by the examiner, "The cross-correlation is calculated by multiplication and creation of a moving average value, or sliding mean.", **not** *time-averaging the cross-multiplied first and second de-rotated sub-band signals* as stated by the examiner.

Applicant respectfully submits that claim 16 is not anticipated by Isaksson et al. and, therefore, is allowable.

Claim Rejections – 35 USC § 103

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Niu et al U.S. Patent No. 6,263,195 B1 in view of Liljeryd et al Pub No 2004/0078205 A1.

Applicant respectfully submits that claim 26 depends on a claim that is believed to be allowable and as such is also allowable.

Allowable Subject Matter

Applicant wishes to thank the Examiner for indicating the allowability of claims 9-15 and 17-22.

Claim Objections

Applicant wishes to thank the examiner for indicating the allowability of claim 7 if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, Applicant believes that claim 7 is dependent on a claim believed to be allowable and, therefore, is also allowable.

Prior Art

The prior art provided but not relied upon by the examiner has been reviewed. However, it is apparent that the references: Springer et al. (US Patent 6,271,787); Allen (US Patent 4,066,842); Niho et al. (US Patent 5,184,134); Atarius et al. (US Patent 6,226,336); Loseke et al. (US Patent 6,449,244); Carney et al. (US Patent 5,848,097); Zangi (US Patent 5,999,573); Wala (US Patent 6,836,660); and Hamdy et al. (US Patent 6,229,998) do not show anything similar to Applicant's invention as defined in the claims above.

Applicant looks forward to receiving favourable consideration of the present application.

Please charge any additional fees required or credit any overpayment to Deposit Account No: 50-1142.

Respectfully submitted,

G Fre

Gordon Freedman, Reg. No. 41,553

Freedman and Associates
117 Centrepointe Drive, Suite 350
Nepean, Ontario
K2G 5X3 Canada

Tel: (613) 274-7272
Fax: (613) 274-7414
Email: gordon@freedmanandassociates.ca

GF/bh